IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
Impact Factor 6.252
Volume 2, Issue 1, July 2022

Route Optimization for E-Commerce Logistic Systems

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Abstract: *E-Commerce Business is widely spread all around the world, and explored by almost half the population of the world, because of its facility that it provides doorstep delivery. You just need to place the order on e-commerce website and within Two to three days max the order gets delivered at your doorstep. But it's a challenge for e-commerce logistic department (ECL) to manage this order and delivery chain. They need to have a predefined strong network of order and delivery chain. While delivering the small parcels e-commerce department considers delivery assistant/ Boy to deliver these parcels. For a Single Delivery assistant it's very hard and headache job to deliver packages accordingly. Here the problem arrives of last mile distribution, completing target deliveries before deadline. This project aims to solve the last-mile distribution of e-commerce logistics (ECL) for the survival of third-party logistics enterprise. Delivery assistant have software which navigates them towards the delivery address. But this creates headache and waste of time while delivering parcels one by one separately without having an optimized route which connects all the target parcels to be delivered in a day. Route Optimization software needs to develop to solve these problems. This project aims to develop an optimized solution on above problems based on multiple source multiple destination approach using Dijkstra's algorithm and scripted using python libraries. On this basis, the improved Dijkstra was proved effective through example analysis on the said test data sets. The analysis results also reflect how the number of vehicles affects the maximum profit of the logistics enterprise and the coverage of the ECL logistics network.*

Keywords: Route Optimization, ACO (Ant Colony Optimization), Dijkstra's Algorithm, Python, ECL (E-Commerce Logistics System), multiple source multiple destination approach, Machine learning (ML).

I. INTRODUCTION

The rural area is becoming the new blue ocean for online consumption, triggering a boom in rural e-commerce logistics (RECL). Under the incentive policy, logistics enterprises start to set up outlets in easily accessible towns. However, the service network of most logistics enterprises has not yet covered villages, owing to their remote locations and poor transportation infrastructure. The existing research on last- mile distribution mainly focuses on densely populated areas like cities, communities and business areas. The relatively few studies on the RECL the associate editor coordinating the review of this manuscript and approving it for publication was Dalin Zhang. Manage to provide reference and theoretical basis for the last-mile distribution of rural logistics. Last-mile delivery has become a critical source for market differentiation, motivating retailers to invest in a myriad of consumer delivery innovations, such as buy-online pickup-in-store, autonomous delivery solutions, lockers, and free delivery upon minimum purchase levels. Consumers care about last-mile delivery because it offers convenience and flexibility. For these reasons, same-day and on-demand delivery services are gaining traction for groceries, pre- prepared meals, and retail purchases. To meet customer needs, parcel carriers are increasing investments into urban and automated distribution hubs. However, there is a lack of understanding as to how best to design last-mile delivery models with retailers turning to experimentations that, at times, attract scepticism from industry observers.

1.1 Dijkstra's Algorithm

Dijkstra's algorithm is very similar to Prim's algorithm for minimum spanning tree. Like Prim's MST, we generate a SPT (shortest path tree) with a given source as a root. We maintain two sets, one set contains vertices included in the shortest-

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path tree, and other set includes vertices not yet included in the shortest-path tree. At every step of the algorithm, we find a vertex that is in the other set (set of not yet included) and has a minimum distance from the source.

III. PROJECT MODULES

The Project is about finding the best shortest route for delivery assistant and displaying it on Google map. Therefore there are various modules used in this project.

The brief overview of the modules used in this project is as follows:

3.1 Data Acquisition

Data For this project is basically the latitude and longitude of exact address of locations. Also the name of locations. This data is manually created in the excel sheet. So this data is in the Format of CSV file.

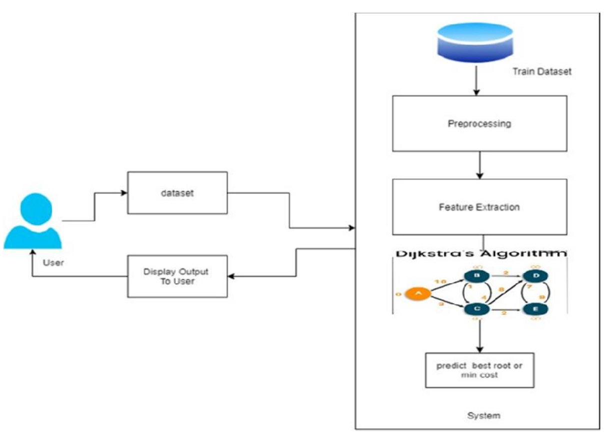
3.2. Applying Machine Learning Logic

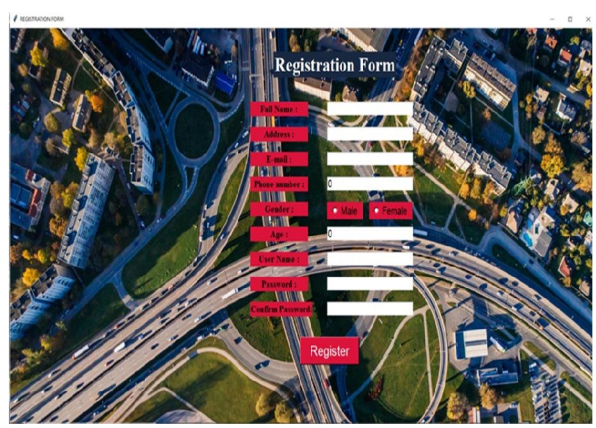
Now the dataset is created, we have to implement the Actual logic which will give us shortest path with the help of Dijkstra’s Algorithm. While doing this Longitude and Latitude are considered as the key concept for finding shortest path. In the development phase we have considered both ACO (ant colony Optimization) and Dijkstra’s Algorithm. On the basis of result Dijkstra’s algorithm gives more accurate shortest path.

3.3. Route Display

Now once the route is shown on the home page, it must be displayed on the Google map. So basically route will be displayed as the start location and the eight stops i.e., delivery addresses. System should correctly execute process; display the result i.e. exact data should be provided. System should be able to display optimized route.

Tools And Technology Used	Purpose
Python	Language used for back-end coding
geopy	For using google map and visualization.
Pandas	For data analysis.
tkinter	For Graphical user interface creating GUI.





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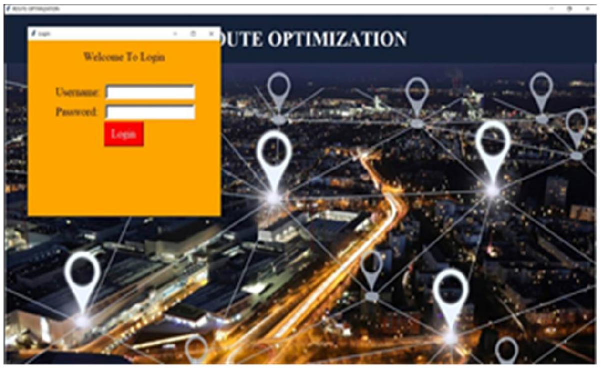

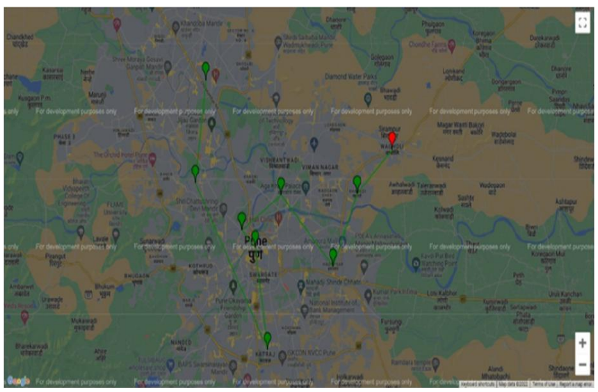

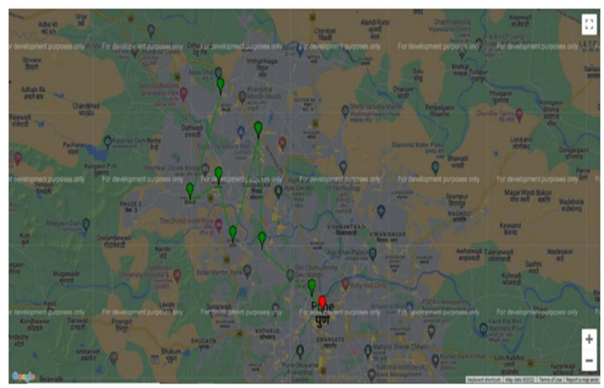

IV. CONCLUSION

Rural E-Commerce Logistics still faces many issues like Vehicle routing problem and issues in supply chain communication, high distribution cost, excess time requirement etc. The model was constructed based on the modelling practices for Route Optimization and Vehicle orientation problems. To solve the established model, the ACO was improved to suit the RECL's last-mile distribution by modifying the heuristic information the update rules of pheromone, solution construction and local search strategy. Besides, the optimal combination of the weight of heuristic factor, the weight of pheromone factor and pheromone volatility was determined through repeated tests on +ve test datasets. Meanwhile, the improved ACO was also varied on these test datasets.

The results show that the improved ACO could provide a feasible routing plan for the RECL's last mile distribution. The research findings lay a solid basis for solving the last-mile distribution in the RECL.

ACKNOWLEDGMENT

We take this opportunity with great pleasure to express our deep sense of gratitude towards our guide Mr. K. A. Shinde for his valuable guidance and incessant encouragement and co-operation extended to us during this project work.

We are also thankful to Dr. G. S. Navale Head, Computer Engineering Department, for providing all departmental facilities for this work.

We would also like to thank Dr. S. D. Markande Principal, Sinhgad Institute of Technology and Science for his unflinching help, support and cooperation during the project work.

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